The American FERTILIZER

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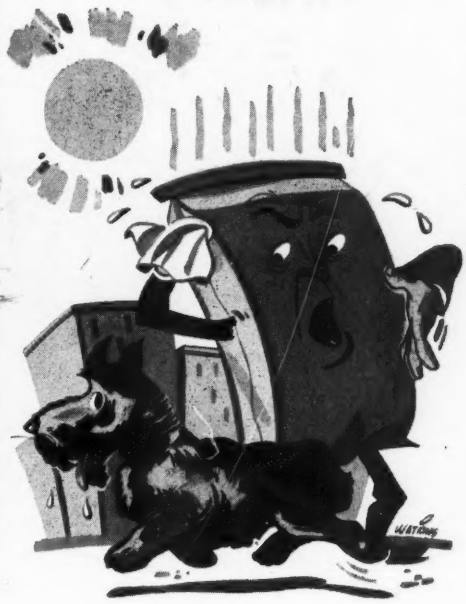
ONE TIE-UP
THAT NEVER CLOSES
A PACKAGE



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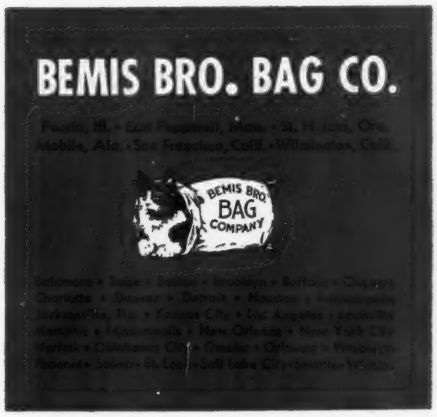

The American FERTILIZER

Vol. 109 DECEMBER 11, 1948 No. 12

The Test of Time*

By DR. FIRMAN E. BEAR

Professor of Agricultural Chemistry and Chairman of the Soils Department
Rutgers University, New Brunswick, N. J.

A CENTURY of experience has convinced real dirt farmers of the value of chemical fertilizers as agents for maintaining soil productivity and for increasing crop yields. But a great many suburbanites and apartment-house dwellers, with only backyard experience to go by, have been led to believe that "chemical fertilizers are ruining our soil and our health."

Because of the doubts that have been raised on these points, it seems advisable from time to time to re-examine the evidence on the subject. The best starting point is an experiment that was established at Rothamsted, England, in 1852, and that has been continued ever since. The records at hand, shown in Table I, cover a period of ninety-five years, and they certainly give no cause for concern.

Now that nearly a century has passed, it is easy to find fault with the original plan of that experiment in relation to the needs of today's agriculture. For example, growing wheat continuously on the same land is not good practice in humid regions. Animal manure is not a balanced soil amendment, since it needs to be reinforced with phosphate. The ratios in which the several fertilizer elements were supplied are not necessarily the ones that are best suited for the long-time needs of the soil and crop. And good soil-management practice calls for growing deep-rooted legumes at regular intervals for their physical effect on the soil, as well as for their usefulness in supplying nitrogen.

TABLE I

NINETY-FIVE YEARS OF CONTINUOUS WHEAT AT ROTHAMSTED†

Average Yields of Grain in Bushels Per Acre

Plot	3	2B	8	7	13
Annual Application	None	Manure tons	Fertilizer lbs.	Fertilizer lbs.	Fertilizer lbs.
Per Acre	....	15.7	1392*	1192*	992*
Periods	bu.	bu.	bu.	bu.	bu.
1852–61	15.9	34.2	36.0	34.6	32.9
1862–71	14.4	37.5	40.5	35.8	34.8
1872–81	10.2	28.7	31.2	26.8	26.7
1882–91	12.5	38.1	38.1	34.9	32.2
1892–01	12.3	39.1	38.5	31.7	29.1
1902–11	10.8	35.1	37.2	30.9	32.0
1912–21	7.9	26.4	25.4	22.4	21.5
1922–31‡	7.6	21.6	21.7	21.7	19.9
1932–41	12.7	26.1	31.0	26.9	25.7
1942–46	15.7	34.3	38.7	35.3	30.8

†The data were obtained through the courtesy of H. V. Garner.

*The 1392 lbs. of fertilizer that were used on plot 8, supplied an estimated 129 lbs. N, 66 lbs. P_2O_5, 102 lbs. K_2O, 17 lbs. MgO, and 14 lbs. Na_2O. On plot 7, the N was reduced to 86 lbs. Plot 13 received the same fertilizer as plot 7, except that no MgO or Na_2O was used.

‡From 1925 forward, a system of fallowing to control weeds, which had become a very troublesome problem under continuous cropping to wheat, was adopted. This is without importance in so far as relative yields are concerned.

*Presented at the 22nd Fall Meeting, The National Fertilizer Association, Atlanta, Ga., November 16, 1948.

Notwithstanding these defects, one cannot fail to note that the plot which received 1,392 pounds of fertilizer annually outyielded the plot receiving an annual dose of 15.7 tons of manure. This is true not only for the first ten years and the first forty years, but for the entire ninety-five-year average. During the last five years, the yield of the fertilized plot averaged 4.4 bushels higher than that of the manured plot.

For those who decry the use of fertilizers, this is a bitter pill to swallow. Not being able to claim any yield advantages for manure, they credit it with certain intangible values. Three claims are made. One is that manured plants have hidden qualities that make them superior for human consumption. A second is that such plants continue to reproduce themselves, whereas fertilized plants "run out," with the result that new seed has to be brought in from other areas. A third is that manure favors the soil-renovating earthworms, whereas fertilizers tend to destroy them.

Evidence Must Confirm Claims

A great variety of miscellaneous observations have been assembled by the antagonists of the fertilizer industry in support of such beliefs. Having made their interpretations of these observations, they assume that these three concepts have been proven, and they state them as facts. Circumstantial evidence of this type merits study, but it cannot be relied upon until substantiated by very careful checking. To date, such checking has failed to yield any dependable scientific evidence that any one of these three concepts is valid. In other words, there is no evidence whatever that fertilizers, *when rightly used*, cause any deterioration of the soil, have any injurious effects on plants or earthworms, or cause any deterioration in the food values of plant products.

The most important reason for saving and using manures and composts, as against fertilizers, is that they can often be had at very little expense. Manure is a very valuable by-product of the livestock industry. It should be carefully saved and used on the soil. In addition to its low cost to the farmer, it may, and often does, have the advantage of containing a greater variety of mineral elements than fertilizers do. Thus it contains some of everything, including the minor elements, that the plant from which it was produced took out of the soil. If the feed that went into the cow came from several regions, so much the better, since this means that the manure is the product of several soils.

The ordinary backyard compost pile may have even greater merit than animal manure, because it is likely to be the product of plants from all over the earth. Thus, waste leaves of cabbage from the Rio Grande Valley, peeling of oranges from Florida, tops of carrots from California, shells of eggs from New Jersey, grounds of coffee from Brazil, spent leaves of tea from China, and plant refuse from the local yard and garden, may all go into the making of the suburbanite's compost pile. No wonder, when he *piles it on heavy*, that he gets such good results from its use.

Those who specialize in educating the public to believe that fertilizers are ruining the the soil and the health of the Nation assume that the cow contributes something to the manure that wasn't in the grain and hay that were fed her. This something would have to be a product of the hormone type. It is further assumed that no such growth-stimulating or health-giving substance can be produced by the microorganisms that inhabit the soil. Otherwise, one could accomplish the same purpose by plowing under sods and cover crops.

Soil Will Digest Organic Matter

In so far as the effects on yield are concerned, there is nothing in the evidence to suggest that organic materials must be passed through a cow if they are to be of maximum benefit to the soil. They must be digested, but this digestion can be accomplished by the microorganisms that inhabit the soil as well as by those that do the necessary work in the cow's rumen. The process is speedier in the cow, just as it is in the well-constructed compost heap, because of the very favorable temperatures that are maintained. It will be slower in the soil, especially in cool weather, but this merely means that a longer period of time will be required for its digestion.

The rate of digestion of plowed-under crude organic matter can often be speeded up greatly by the supplemental use of chemical nitrogen and phosphorus. The explanation for this is found in the fact that microbial cells contain around 10 per cent nitrogen and 5 per cent phosphoric acid, on the dry basis. If the plowed-under material is naturally rich in these two elements, no additions of them are necessary. Thus, no problem of this type is presented by the plowing under of green sweet clover, soybeans, alfalfa sods, and other similar legume crops. When straw, cornstalks, timothy sods, and similar mate-

rials are plowed under or worked into the soil, extra nitrogen is required. Straw, for example, contains only about 0.75 per cent nitrogen, and enough more of the element must be added to raise this to about 2 per cent. This is approximately the nitrogen content of legume hay crops at the early blossom stage.

This principle can be applied to good effect in the making of compost. Thus, it is now common practice to sprinkle cyanamid, or sulphate of ammonia plus lime, over the successive layers of plant material as they go into the compost heap. In ordinary practice, about 60 pounds of cyanamid, or 120 pounds of a half and half mixture of sulphate of ammonia and pulverized limestone, and 30 pounds of superphosphate per ton dry-weight of material meets the requirements. Most backyard gardeners will find it more convenient to use about 200 pounds of a standard complete fertilizer and a small quantity of lime instead of the separate materials.

It must be kept in mind that the chemicals are used merely to speed up the decomposition process. Any pile of plant refuse will, if kept moist, gradually decay to form compost. By adding the lime and fertilizer, the microbes are stimulated to more speedy action. Thus, the chemicals are substitutes for time. For those who appear to be so disturbed about the use of chemicals, it might be well to point out that chemical nitrogen is now being fed to cows on a large scale. The microbes that digest the feed in the cow's rumen often need more nitrogen than is contained in the grain and roughage that are fed. In proportion as such a need exists, extra nitrogen, in the form of urea, is being used to good effect. The nitrogen is required for the necessary production of protein in the bacterial cells.

The importance of manure as a direct source of organic matter in general farming, has been greatly exaggerated. Used at the 100-ton-or-more-per-acre rate at which the backyard gardener may apply it, or the compost that he substitutes for it, very marked improvement in both soil and crop can be effected. But a 10-ton-per-acre application, such as a farmer might have at his disposal, would add only about 2½ tons of organic matter, of a readily decomposable type, to the 30 tons of organic matter already in the plow depth of the average acre of soil. Any very large and dependable increase in soil organic matter from the use of manure will not come from the manure itself, but from the larger crop yields that are produced by the manure, and the greater amounts of roots and crop residues associated therewith.

But fertilizers can be used to accomplish the same purpose. They grow bigger crops that leave larger amounts of plant refuse on and in the soil. The most conclusive evidence on this point so far presented is that which was developed by Dr. R. M. Salter and myself at the West Virginia Agricultural Experiment Station some thirty years ago. A small part of the data from this work is shown in Table II.

TABLE II

FIFTEEN-YEAR ACCUMULATION OF ORGANIC MATTER AT WEST VIRGINIA*

(All figures calculated to the acre basis for entire period)

Materials Applied	Quantities Applied Tons	Amounts of N lbs.	P_2O_5 lbs.	K_2O lbs.	Crop Produce Totals lbs.	Organic Matter in Plow Depth lbs.
None	...	....	...	....	40,960	42,800
Fertilizer†	5	672	672	812	117,910	60,800
Manure	190	1,900	950	1,900	139,670	73,600

*Bear, F. E., and Salter, R. M., "The Residual Effects of Fertilizers." West Virginia Agricultural Experiment Station, Bulletin 160, 1916.

†Consisting of a mixture of nitrate of soda, superphosphate and sulphate of potash.

During the fifteen year period of this test, four clean-culture, five small-grain, and six clover-timothy hay crops were grown. Manure and fertilzers, used at rates of 190 tons and 5 tons per acre, respectively, were compared on nearby plots. The manure produced higher yields than the fertilizer, but this was to be expected, since it supplied more than twice as much N, P_2O_5 and K_2O as the fertilizer.

It will be noted that the soil's content of organic matter, to plow depth, was increased from 42,800 to 60,800 pounds, or over 42 per cent, by the use of purely mineral fertilizers. This can be accounted for only by the greater amounts of roots and other crop residues that were left behind on and in the soil by the nearly tripled crop yields resulting from the use of the fertilizer.

(Continued on page 24)

The TVA and the Fertilizer Industry*

By GORDON R. CLAPP

Chairman of the Board, Tennessee Valley Authority

DURING the past year your Association and the TVA have begun to re-explore mutual interests. By meetings and correspondence we have tried to find a basis for constructive cooperation—cooperation that does no violence to the integrity of the basic purposes and methods of each. We believe the effort has been worthwhile; I think we understand each other a little better.

For the TVA I can say that these discussions have left us with the conviction that there *are* important areas of work offering opportunities for constructive relationships with your Association that will advance the public interest.

We recognize that you are engaged in a complex business. Your membership includes many business enterprises large and small. Your business affects the farmer. It affects the farmer's use of the land, and those who consume the farmer's products. The kinds and amounts of fertilizers you manufacture and sell and the ways in which they are used—these things affect the kind, quality and quantity of the ways the land can produce to feed and clothe people and to supply industry with raw materials.

The TVA is engaged in a complex program which has for its primary objective the strengthening of an entire region. TVA's responsibilities embrace a pervasive concern for the abundant water which can be a blessing or a curse in its effects upon the welfare of the people of the region and the nation. That is why the TVA dams have been built—to control and use water for human benefit; that is why TVA concerns itself with the problems of making water work for the people who live on the land.

Because your interests and TVA's responsibilities at several points affect the same things—farmers, the soil, the consumers of food—our respective interests inevitably affect each other.

Your Association has rediscovered the TVA in the past two or three years. Shortages of phosphate and nitrogen have plagued your ability to meet the fertilizer demands of farmers. Under these circumstances, any producer of basic chemical nitrogenous or phosphatic materials has been sought out by the fertilizer industry as a possible source of supply.

Your recent interest in the TVA seems to be based upon these circumstances. We produce triple superphosphate and ammonium nitrate at Mussel Shoals. Our production is a small part of the nation's total supply. You know and farmers know that both materials are efficient fertilizers. Naturally, you want TVA to turn the output of our operations, especially the nitrogen, into the mixing and distributing channels that lie between the chemical industries and the farmer and his land. But when you began to offer to buy these materials from the TVA, you found that these materials were being committed to a long range educational program under distribution arrangements which had been worked out primarily through farmers' associations and cooperatives.

Your members and the TVA have discussed this problem. We have enjoyed a most extensive correspondence with many of you. It seems clear that our relationships for the moment could be welded together if we were to withdraw TVA ammonium nitrate from farmer-controlled distribution channels and transfer it to you. But it is clear to TVA, after the most careful examination of this proposed change in distribution policy, that such a change would add nothing to and might subtract much from TVA's ability to help farmers revise their farming practices, shift their land use, and thus help control and use the abundant water resources of the Tennessee Valley and elsewhere.

We are sure that such a solution would not serve the interest of the farmers, of the consumers of food and fiber, or of the nation as a whole. It is not clear to us that a change in our distribution policy would even serve the long-run interest of the fertilizer industry.

The fertilizer industry can get a great deal more benefit from what the TVA is doing

*An address at the Fall Convention of the National Fertilizer Association, Atlanta, Ga., November 17, 1948.

than a certain tonnage of nitrate or phosphate. TVA's nitrate, for example, if equally distributed among the fertilizer dealers of the Tennessee Valley alone, would supply less than a carload to each dealer. It is difficult to believe that relationships between the members of this Association and the TVA will stand or fall on such a small and fleeting issue. We would hope that you might be interested in the broader range of services the TVA has rendered and will continue to provide—services that should be of fundamental interest to the fertilizer industry.

One of these services, the test-demonstration farm program, is raising the level of efficiency of the whole farm system through the use of fertilizer, and thus increases the value of fertilizer to the farmer. The other maor service, research in new processes and products, is increasing the concentration of the product and pointing the way to lower costs to the industry and to the farmer.

The record is clear, I believe, that these two fields of service benefit you as well as the farmer. These services help to expand and stabilize the market for fertilizer by increasing its value and lowering ts cost to the farmer. We confidenty expect that, among other things, TVA's new processes and products will provide the means for utilizing the western phosphate deposits to serve the expanding fertilizer requirements of the Central West.

Because these services and their effects contain the basis for constructive cooperation between your Association and the TVA I want to discuss each one in brief detail.

1. *The TVA Program Has Increased Your Market*

As you know, the TVA, with the assistance of the land-grant colleges, the Agricultural Extension Services, and tens of thousands of farmers in their organizations and associations, is carrying on a test-demonstration program. In this program TVA experimental fertilizers are tested and demonstrated on privately owned farms, operated as practical farming units. On these farms more efficient use of fertilizer makes possible more efficient long-range farm management systems, thus realizing for the farmer the full value of his fertilizer.

For your purposes the test-demonstration program can be accurately regarded as a successful attempt to develop and educate new fertilizer markets. The educational use of TVA materials on the soils of the Tennessee Valley and elsewhere has increased your sales of fertilizers to farmers.

Here are a few facts: Between 1935 and 1943, the consumption of normal superphosphate in the U. S. increased 58 per cent. In the Tennessee Valley states the increase was 63 per cent; in Tennessee, 63 of whose 95 counties are in the Tennessee Valley, the increase during the 1935–1943 period was 99 per cent.

Recently we compiled figures showing the increases in the consumption of commercial fertilizer in the 107 counties of the Tennessee Valley, compared with consumption in the 258 counties outside the Valley but in the states of Alabama, Georgia, North Carolina, and Tennessee. Between 1935 and 1948 the average increase in the sale of commercial fertilizer in the non-Valley counties was 63.5 per cent. In the Valley counties, where the number of active test-demonstration farmers has averaged about 12,000, the increase was 232.3 per cent, nearly four times as much. Note that this increased sale of commercial fertilizer in the test-demonstration areas is over and above the TVA phosphate allotted to test-demonstration farmers. What happens is that both the test-demonstration farmers and their neighbors buy greatly increased amounts of fertilizer. The more intensive the test-demonstration activity and the longer it is maintained, the more the use of the TVA materials stimulates sales of commercial fertilizer.

2. *A Diversified Agriculture Will Improve the Stability of Your Markets*

The test-demonstration program as carried on in the Tennessee Valley and elsewhere is doing more than creating a new market for the sale of your products; this program is encouraging farmers to transform their farming methods by the introduction of practices that are essential to the full development of the soil and water resources and the welfare of the people.

In the fifteen years the TVA has been at work with the agricultural agencies and the farmers of the Tennessee Valley, one million acres have been shifted from open cultivated crops to grass and cover crops.

The acreage of pasture has increased 14 per cent.

The application of phosphate and lime to grass and pasture lands is becoming an established and expanding practice.

Land in row crops in the Tennessee Valley *decreased* 19 per cent while in the United States as a whole row crop acreage *increased* 2 per cent.

(Continued on page 20)

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Principal Articles in This Issue

Report of N. F. A. Plant Food Research Committee

The Plant Food Research Committee of the National Fertilizer Association has published a brochure of 69 pages covering the work of this important group during the 1947–1948 crop year. Under the chairmanship of Dr. H. B. Siems, and working through 17 sub-committees, the report summarizes the experimental work on fertilizers and allied subjects which is being done by various experiment stations.

For the work during 1948–49, the following sub-committee assignments have been made by Chairman Siems:

Cotton.—Leroy Donald, chairman; J. A. Naftel, T. F. Bridgers.

Pasture.—J. A. Naftel, chairman; R. D. Martinet, Nelson T. White.

Water Relations and Fertilizer Usage.—J. A. Chucka, chairman; M. E. McCollam, H. B. Siems.

Correlation of Agronomic and Chemical Problems.—M. F. Gribbins, chairman; H. B. Siems, G. N. Hoffer.

Nutritive Value of Crops as Affected by Fertilizers.—J. F. Wood, chairman; Nelson T. White, W. F. Nichols.

Methods and Time of Fertilization.—H. B. Mann, chairman; Malcolm H. McVickar, M. E. McCollam.

Corn.—P. W. Gull, chairman; Robert H. Engle, T. F. Bridgers.

Techniques.—G. N. Hoffer, chairman; J. F. Wood, F. H. Leavitt.

Chemical Weed Control.—M. V. Bailey, chairman; E. N. Carvel, Wallace Macfarlane, Leroy Donald, H. H. Tucker.

Vegetables.—A. L. Grizzard, chairman; E. N. Carvel, Bailey E. Brown.

Small Grains.—H. H. Tucker, chairman; C. J. Cahill, Nelson T. White.

Legumes Other than Pasture Legumes.— D. D. Long, chairman; R. D. Martenet, C. J. Cahill.

Fruits.—S. D. Gray, chairman; G. F. MacLeod, Bailey E. Brown.

Tobacco.—B. S. Chronister, chairman; W. F. Nichols, H. B. Mann.

Citrus.—Ward H. Sachs, chairman; F. H. Leavitt, Wallace Macfarlane, G. F. MacLeod.

Revision of Hunger Signs in Crops.—R. H. Engle, chairman; S. D. Gray, G. N. Hoffer, H. H. Tucker, Malcolm H. McVickar.

Publicity.—Malcolm H. McVickar, chairman; Robert H. Engle, H. B. Siems.

H. B. Mann Made President of American Potash Institute

Dr. H. B. Mann has been appointed by the Directors of the American Potash Institute to become President and a Director of the Institute, following the retirement of Dr. John W. Turrentine on January 1. A native North Carolinian, Dr. Mann is a graduate of North Carolina State College, received his Ph.D. degree from Cornell University, and was a member of the North Carolina Experiment Station Staff where he served for 16 years as agronomist in soil fertility work. In 1936 he joined the Institute as manager of its Southern territory and was made vice-president in January of this year. He is well-known throughout agricultural circles because of his soil fertility investigations and association with scientific organizations.

Dr. Turrentine, widely known in the fields of agricultural science and chemical engineering, will not sever completely his connection with the Institute which he has ably headed since its founding in 1935. He will continue in the capacity of consultant with the title of President Emeritus.

Fertilizer Supply Outlook for 1948-49

Despite a generally brighter outlook for fertilizer this year, prospects for nitrogen are only slightly better than last year and supplies can be expected to continue tight, warns the United States Department of Agriculture in a fertilizer supply report released on December 7th. This estimate for the 1948-49 fiscal year indicates that instead of an earlier estimated increase of 10 per cent, supplies of nitrogen for the current fiscal year will level off at about a 7 per cent increase.

This change in the anticipated supply picture has come about as the result of unforeseen operating difficulties and production problems which have tended to curtail output at a few plants.

Phosphate supplies for fertilizer purposes are expected to reach 2,100,000 tons P_2O_5 as compared with about 2,000,000 tons available for the 1947-48 fiscal year. Potash is estimated at 1,020,000 tons K_2O as compared with about 920,000 for the 1947-48 fiscal year. This means about 5 per cent more phosphate and 10 per cent more potash. About 955,000 tons of nitrogen will be available for commercial fertilizer for the 1948-49 year as compared with about 888,000 tons last year.

In connection with these latest estimates, U.S. Department of Agriculture officials say that farmers should realize that supplies of nitrogen fertilizers are not being increased uniformly over the country and some regional variation can be expected. The curtailed production early in the year appears to have affected particularly the supplies of nitrogen solutions available for mixed fertilizers in the East and South. Farmers in those areas are cautioned by the Department not to put off until the last minute the making of arrangements for essential supplies.

This report on the fertilizer situation indicates that nitrogen will continue to be the most troublesome problem, both as to quantity and for mixing purposes and for straight application.

Louis Ware Elected Director of Illinois Central R. R.

Louis Ware, president of International Minerals & Chemicals Corporation, was elected a director of the Illinois Central Railroad Company at a meeting of the Board of Directors on November 30th. He succeeds James Norris, president of the Norris Grain Company.

Mr. Ware is a mining engineer, having graduated from the College of Mining Engineering at the University of Kentucky in 1917. His experience began in the copper mines of Arizona, where he worked as miner, underground boss and general foreman. He was with the Arizona Commercial Mining Company from 1919 to 1921 as mining engineer and in charge of mine construction. He was later with the Iron Cap Copper Company as chief engineer and the Miami Copper Company as general foreman and superintendent. In the period 1926-29 he was general mine superintendent for Guggenheim Brothers, in charge of large mining operations in Chile, South America.

Returning to the United States, Mr. Ware became a consulting engineer in New York. In 1930 he became affiliated with the New York Trust Company, where he had engineering and business assignments. From 1935 to 1939 he was president and director of United Electric Coal Companies and Coal Sales Corporation at Chicago. Since 1939 he has been president and director of International Minerals & Chemicals Corporation. He is also a director of the First National Bank of Chicago and of U.S. Gypsum Company.

Tax Tag Sales for November

Reports to The National Fertilizer Association from State control officials in the 14 States requiring fertilizer tax tags indicate that during November such sales were equivalent to 552,000 short tons, a 14 per cent drop from the 645,000 tons reported for a year ago. Compared with November 1946, however, sales were 10 per cent higher. Last year there was a 33 per cent increase in sales from October to November, while this year the percentage change for the same two months was only a 5 per cent increase.

Sales in the ten Southern States, which amounted to 440,000 tons, fell five per cent from a year ago, but were slightly above those of November 1946. Compared with last November, sales in five of these States were lower—decreased ranging from less than 2,000 tons for Virginia to 35,000 tons for South Carolina. The increases for the remaining five States ranged from 168 tons for Texas to over 25,000 tons for Georgia. The tonnage reported for Florida and Georgia, respectively, were the greatest of all 14 States. As a percentage of total November sales, the ten Southern states accounted for 80 per cent, compared with 72 per cent a year ago.

The four Midwestern States, with total November sales of 112,000 tons, showed a 38 per cent decrease from the 182,000 tons reported for a year ago. Compared with November 1946, however, sales were 65 per cent greater. The marked decline from sales of a year ago was largely the result of a decrease in the tonnage indicated for Indiana. Last November, sales in that State amounted

(Continued on page 22)

FERTILIZER TAX TAG SALES

COMPILED BY THE NATIONAL FERTILIZER ASSOCIATION

State	November 1948 Tons	November 1947 Tons	November 1946 Tons	November % of 1947	January-November 1948 Tons	January-November 1947 Tons	January-November 1946 Tons
Virginia	18,577	20,345	21,450	99	602,306	610,665	617,670
N. Carolina	79,646	107,640	109,757	96	1,402,876	1,455,474	1,480,129
S. Carolina	46,650	81,550	62,380	98	827,120	844,239	843,400
Georgia	79,958	54,508	34,163	111	1,132,607	1,019,369	1,052,322
Florida	91,229	99,848	116,394	86	662,404	772,881	970,682
Alabama	39,821	31,585	51,200	138	901,618	653,885	817,250
Tennessee	41,339	30,709	13,605	125	421,263	337,807	318,239
Arkansas	17,808	10,369	6,800	147	230,603	156,648	148,350
Texas	21,283	21,115	16,830	118	435,120	368,863	330,913
Oklahoma	3,500	6,125	2,000	150	120,486	80,557	52,936
Total South	439,811	463,794	434,579	107	6,736,403	6,300,388	6,631,891
Indiana	63,949	123,669	54,313	104	746,349	715,309	565,930
Kentucky	45,108	56,055	13,415	122	499,443	408,450	305,056
Missouri	2,413	1,608	185	172	391,296	227,344	252,163
Kansas	900	250	5	105	109,578	104,308	58,868
Total Midwest	112,370	181,582	67,918	120	1,746,666	1,455,411	1,182,017
Grand Total	552,181	645,376	502,497	109	8,483,069	7,755,799	7,813,908

FERTILIZER MATERIALS MARKET

NEW YORK

Shortage of Chemical Nitrogen Materials Shows No Improvement. Demand from Feed Trades Raises Prices on Organics Far Above Fertilizer Levels. Superphosphate Moving in Better Volume. Potash Shipments Improve.

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, December 8, 1948.

Sulphate of Ammonia

With nitrogen solutions scarce in some sections, buyers were trying to obtain larger quantities of sulphate of ammonia but practically all producers were under contract for the present fertilizer season.

Nitrate of Soda

The East Coast maritime strike temporarily suspended shipments of this material at some ports but with the strike over, a more normal shipping situation has developed.

Ammonium Nitrate

Producers unable to fill demand, with supply smaller from certain producers.

Organics

With feed buyers still seeking supplies of tankage, blood and other packing house by-products, it was difficult for fertilizer people to obtain necessary supplies at reasonable prices. Most fertilizer buyers have switched into other materials such as castor pomace and nitrogenous tankage because of present high prices of tankage and blood. Sales of tankage and blood were made at prices ranging from $9.50 to $10.00 per unit of ammonia ($11.55 to $12.15 per unit N), f.o.b. eastern shipping points and even at these prices the supply was limited. Soybean meal, after having advanced sharply, was showing some hesitation around present levels of $72.00 to $75.00 per ton, f.o.b. Decatur, Ill. in bulk. Linseed meal sold at $70.00 per ton, f.o.b. Minneapolis, for prompt shipment, and cottonseed meal was firm, with some mills sold ahead until February.

Castor Pomace

Had the East Coast maritime strike continued, some of the producers might have been forced to shut down, due to lack of raw material. One producer was obliged to cut production for about a week but was now reported back on a normal producing schedule.

Nitrogenous Tankage

This material was reported moving rather poorly but some pickup is looked for after January 1st when the heavy mixing season starts. No price changes were announced.

Garbage Tankage

Some material was sold for shipment next year and demand for this material is good in certain sections.

Fish Meal

Scattered trading was reported and mostly in re-sale lots at prices up to $145.00 per ton for fish meal and $130.00 per ton for fish scrap. Fertilizer buyers showed little interest at prevailing prices and most sales were made to the feed trade.

Bone Meal

Due to the heavy demand from the feed trade, producers have been unable to supply fertilizer customers with their entire needs and it is considered likely that this situation will prevail for some months ahead. No spot offerings were reported.

Hoof Meal

Last sales made at $7.00 per unit of ammonia ($8.51 per unit N), f.o.b. shipping points, with very little material offered.

Superphosphate

The Government was in the market for a large quantity and asked for bids which, in some years past, has taken about one-quarter of the domestic production. Producers are moving the material more freely to regular contract customers.

Potash

While some French potash was reported recently sold, no other offerings were heard of foreign potash. Domestic producers were shipping against previous contracts and were said to be having little trouble in obtaining necessary freight cars to make shipments.

PHILADELPHIA

All Chemical Nitrogen Supplies Under Contract with Little Re-sale Material. Organics Advance in Price with Supply Short

Exclusive Correspondence to "The American Fertilizer"

PHILADELPHIA, December 6, 1948.

Chemical nitrogen requirements continue to be greater than the potential supply, and producers' prices are higher than last season. Very little resale material is available, and it is fully expected that the supply will remain inadequate throughout the season. The general market is rather quiet.

Sulphate of Ammonia.—This article remains decidedly scarce, with the demand very active. However, it is expected that during the coming year production facilities will be greatly increased.

Nitrate of Soda.—There is no slackening in the demand, and available supplies are quickly absorbed. The dock-workers strike only slightly interfered with the delivery of Chilean arrivals.

Ammonium Nitrate.—Production is well under contract, but quite unequal to the demand. Shipments are reported considerably behind schedule.

Cyanamid.—Although a higher price schedule became effective November 29th, demand continues ahead of the supply.

Castor Pomace.—No spot offerings are reported as production is practically all under contract.

Blood, Tankage, Bone.—The organics market continues strong with supplies not too plentiful. Both tankage and blood are quoted at $9.25 per unit of ammonia ($11.24 per unit N). Bone meal is quite scarce and no spot offerings noted.

Fish Scrap.—Stocks are not very ample and market is very firm. Scrap has been offered at $125.00 to $130.00 per ton, with menhaden meal at $135.00 to $140.00.

Phosphate Rock.—Shipments continue per schedule and production keeps well up with demand. Market remains firm.

Superphosphate.—Situation is normal and the supply is fully equal to demand. No price changes are reported.

Potash.—While no consideration is being given to new business, deliveries against contracts are proceeding practically per schedule. There is considerable demand for tonnage in addition to existing contracts. Offerings from Europe are increasing, and increased domestic production facilities are under construction.

CHARLESTON

Superphosphate Production Drops but Supplies Adequate. Nitrogen Shortage Continues. Potash Shipments on Schedule

Exclusive Correspondence to "The American Fertilizer"

CHARLESTON, December 6, 1948.

Production of superphosphate reached the second lowest point reported for the year but present stocks are sufficient for current demand. Nitrogen continues to be the prime factor governing the output of mixed fertilizers. Potash production is on schedule but insufficient to take care of the total demand.

Organics.—Interest is slack in organics on the part of the fertilizer trade but the feed market has been active recently, resulting in advanced prices on tankages, blood and fish meal. Domestic nitrogenous continues at prices ranging from $3.50 to $4.00 per unit of ammonia ($4.25 to $4.86 per unit N), f.o.b. works, depending on the location of the production point. South American organics continue too high in price for the fertilizer trade.

Castor Pomace.—Some prompt castor pomace has sold at $27.50 in bags, f.o.b. eastern production point, but movement is mainly against existing contracts.

Dried Ground Blood.—On the Chicago

market, blood continues firm with buyers declining to pay the prices asked. Sellers' ideas are $10.00 per unit of ammonia ($12.15 per unit N), with buyers' ideas around $9.50 ($11.55 per unit N). The New York market is quiet with sellers' ideas around $10.00 ($12.15 per unit N), and buyers' ideas at lower figures.

Cyanamid.—Higher prices are now effective and demand continues stronger than the apparent supply.

Potash.—No change in the domestic price schedules has been reported. Movement is steady against regular contracts with transportation facilities adequate. Demand continues stronger than supply.

Phosphate Rock.—Demand and supply are fairly well in balance. Prices are steady.

Superphosphate.—September production figures indicate that approximately 56,000 tons less normal superphosphate was produced this year as compared with last year. However, the output of concentrated triple superphosphate in September was 15,000 tons greater than for the same month of 1947. Demand on the part of dry mixers is rather steady and increasing as the season progresses.

Sulphate of Ammonia.—Supply continues short of demand and output of synthetic technical during September was approximately 2,000 tons less than during September, 1947.

Ammonium Nitrate.—The market continues tight due to short supply. Imported and domestic productions are heavily under contract.

CHICAGO

Organic Prices Show Upward Trend. Shipments Moving Steadily

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, December 6, 1948.

The midwest market on animal ammoniates continues in a strong position and further advances have been established during the past two weeks. Finished product is moving at a steady pace although preference is still shown for material for nearby delivery.

Meat scraps are selling at $110.00 per ton, sacked, and digester tankage at $117.50 per ton. Dry rendered tankage ranges in value from $1.90 to $2.00 per unit of protein, depending upon quality and shipping point of material involved.

Dried blood last sold at $9.50 per unit of ammonia ($11.55 per unit N), and up to $10.00 ($12.15 per unit N) is now asked. Wet rendered tankage remains firm at $9.25 to $9.50 per unit of ammonia ($11.24 to $11.55 per unit N), with sellers expressing asking prices of 25 to 50 cents higher. Steamed bone meal, 65 per cent B.P.L., is steady at $65.00 to $67.00 per ton and raw bone meal, 4½ per cent ammonia and 45 per cent B.P.L., at $65.00 per ton.

Superphosphate "In Abundance," Says Woodrum

Supplies of superphosphate, a major plant food, now are in "abundant supply" for the first time since 1941 and "indications are that farmers will have about 2,100,000 tons for the 1948-49 season, or more than enough to satisfy their demands," Clifton A. Woodrum, president of the American Plant Food Council, said recently.

He reported that the indicated supply of more than two million tons of P_2O_5 for next season compares with less than a million tons in 1941, representing an increase of more than 100 per cent.

"Indications that superphosphate supplies are exceeding demands are forcefully demon-

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strated by the fact that the U.S. Department of Agriculture recently asked bids on about 56,000 tons for use in conservation programs in seven states and as a result received offers from private industry of about 397,000 tons," Mr. Woodrum said.

"The phenomenal increase in the production of superphosphate during the critical war and post-war periods presents tangible evidence that private industry, given a fair opportunity, can and will meet the demands of farmers in the future as they have been met so abundantly in all normal periods in the past."

Mr. Woodrum said the record of superphosphate production "is all the more remarkable in view of the industry's difficulties in obtaining essential machinery, building materials and supplies for expansion."

Chester Joins Agricultural Staff of Battelle Institute

Dr. K. Starr Chester, nationally known authority on plant pathology, has joined the staff of Battelle Institute, Columbus, Ohio. He will head the Institute's research program in the agricultural sciences and in plant and animal nutrition.

According to Battelle Director Clyde Williams, the appointment of Dr. Chester to the Battelle staff is a preliminary move toward the expansion of the Institute's research activities in the agricultural field. During the past five years, Battelle has been conducting studies on the effects of trace elements in soil on plant health and nutrition. The results of these investigations indicate that better understanding of the role of trace elements in plant nutrition may lead to increased production and improved quality of agricultural products. The expanded research program will emphasize such studies and also include work on insecticides and fungicides, herbicides, fertilizers, and other problems related to agriculture.

Powell Transferred to Bemis' Memphis Plant

W. F. Powell has been appointed Assistant Sales Manager at the Memphis plant of Bemis Bro. Bag Co. His career with Bemis started in 1921 when he joined the company as an office boy at Memphis. Mr. Powell soon transferred to the order department and later to the accounting department where he served as accountant and credit manager for 13 years.

THE TVA AND THE FERTILIZER INDUSTRY

(Continued from page 11)

With fewer acres in row crops, there has been a more intensive cultivation and greater use of fertilizers to increase the total yields of corn cotton and tobacco on less land, thereby helping the farmer to finance his new crop rotation systems, his new emphasis upon phosphate, pastures and livestock. This brings a rapid increase in the diversity of farm products; and with this reform the farmer's income will be less sensitive to the fluctuations of price on a single cash crop. Grass, pastures and livestock in addition to corn, cotton and tobacco, will help to stabilize your fertilizer markets. Your business can become less dependent upon the price of a few cash crops—as it is now and has been for too long.

These results are important byproducts of the farm test-demonstration program. TVA's primary objective is the development and use of fertilizer as a tool in a regional demonstration of soil and water conservation and use. It is well known that regularity and volume of stream flow are influenced by the kind of crops grown on the watershed and the seasons at which they make their maximum growth. It is not so well known that the farmer can use that fertilizer in managing his land to serve both his own interest and that of helping to regulate stream flow in the interest of the region and the nation.

One of the things we are learnng through the test-demonstration program is how best to use TVA's new fertilizer materials to shift

the prevailing farm systems of the Tennessee Valley from dependence on summer row crops, that make their maximum use of water when it is most needed in the streams, to a greater use of winter sod crops, which reach their peak use of water during the spring flood season. As farmers shift from corn to winter grown pastures and grains they check erosion losses; they build and maintain the fertility of the soil. This increases the utility of the water resources of the whole region.

TVA's experience in the utilization of fertilizers to adjust land use in the interest of better control and use of rainfall is readily applicable on other watersheds. As these practices spread, they produce a new demand for fertilizers over and above ordinary uses. In helping to develop this demand, the TVA as a regional demonstration in soil fertility conservation serves as a pilot plant operation conducted in the interest of the nation as a whole.

I suggest that the fertilizer industry can gain great benefit from this regional demonstration if it will study its effects and be prepared to meet the mineral requirements of the soil in this and other regions.

(To be continued in the next issue)

NOVEMBER TAG SALES

(Continued from page 14)

to 124,000 tons, the highest figure reported for any of the 14 States, while this November such sales were down to 64,000 tons. Reported sales for Kentucky were off almost 11,000 tons from a year ago, and Missouri and Kansas both recorded slight increases.

For the first 11 months of the year, tax tag sales in the 14 reporting states were equivalent to 8,483,000 short tons, a 9 per cent increase over the 7,756,000 tons reported for the same period last year. In 1946 and 1947, January-November sales accounted for 90 per cent of annual sales; if that same ratio continues this year, total sales for 1948 will be over 9,400,000 equivalent short tons.

The ten Southern states, with total sales of 6,736,000 tons, reported a seven per cent increase over the same period last year and a two per cent increase over January-November 1946. Compared with last year, January-November sales were greater for six states, increases ranging from 11 per cent for Georgia to 50 per cent for Oklahoma. The remaining four States reported decreases, with that for Florida being the greatest. On a tonnage basis, cumulative sales among the 14 states

were greatest for North Carolina, Georgia and Alabama, in that order. January-November sales for the ten Southern states comprised 79 per cent of total sales, compared with 81 per cent for the same period last year.

In the four Midwestern states, cumulative sales were equivalent to 1,747,000 tons, an increase of 20 per cent over the same period last year and 48 per cent over January-November 1946. Compared with the first 11 months of last year, sales were higher for all four states, with increases ranging from four per cent for Indiana to 72 per cent for Missouri. Cumulative sales for Indiana, of 746,000 tons, were the greatest of the Midwestern states and, of all 14 states requiring monthly tax tag reports, were exceeded only by North Carolina, South Carolina, Georgia and Alabama.

Total sales in the 14 States for July-November, the first five months of the current fiscal year, amounted to 2,363,000 short tons, a slight increase over the same period in the 1947–1948 fiscal year. Compared with that period, both regions, Southern and Midwestern, reported slight increases.

THE TEST OF TIME

(Continued from page 9)

Most of the extra organic matter that was accumulated in the manured plot can be accounted for in the same manner. Thus, by using the yield data, one can readily calculate that only about 8,000 of the 95,000 pounds dry-weight of organic matter per acre which was supplied by the manure remained in the soil at the end of the fifteen-year period. The remaining 22,800 pounds of extra organic matter that had accumulated in the soil during the fifteen-year period came from the roots and residues of the larger crops that were grown by its use.

The yield-increasing effectiveness of manure, when applied at ordinary farm rates, is determined mostly by its content of N, P_2O_5, K_2O, and by such other mineral elements as are released from it during decay in the soil. Microbial decomposition is a low-temperature ashing process. It yields the same mineral elements as would be found in the ashes if the manure was consumed by fire. During the low-temperature ashing by the microbes, however, the N, which would have gone up in smoke at high temperatures, is saved and made available to the crop. If one burned manure, and then added as much N to the ashes as was lost in the burning process, he would then have what the manure contributes in the way of fertilizer elements.

For two years, a direct comparison was made of 20 tons of manure per acre annually and the ashes from burning the same quantity of manure, to which the necessary mineral nitrogen to make up the loss of this element was added. Crop data for this com-

TABLE III

TWO-YEAR COMPARISON OF MANURE AND MANURE-ASH PLUS NITROGEN AT WEST VIRGINIA

(All figures calculated to the acre basis)

Material Applied	Rye		Wheat		Total Dry Weight
	Grain lbs.	Straw lbs.	Grain lbs.	Straw lbs.	lbs.
Manure, 20 tons	1,913	3,587	1,920	4,580	12,000
Ashes* + N	2,095	4,845	1,880	3,320	12,140
None	1,100	2,070	1,070	1,830	6,070

*Ashes from burning 20 tons of manure plus N equivalent to that lost by burning.

parison are shown in Table III. The soil on these plots was in a low state of fertility. Nevertheless, it will be noted that the manured plot did not produce as much dry-weight of crop as the fertilized plot. No discernible extra values were obtained from the microbial and organic constituents of the manure.

It will be noted, however, that the manure produced a higher yield than the fertilizer during the second year. It becomes necessary, therefore, to examine this point further. In 1915 the Ohio Experiment Station set up a test to compare 4 tons of manure per acre with chemical fertilizers containing the same amounts of N, P_2O_5, K_2O. This experiment was continued for twenty-three years. The rotation was corn, oats, wheat and clover. The manure and fertilizer were all applied in preparation for corn. The data on crop increases are shown in Table IV.

After forty years of study of this problem, Charles E. Thorne, then Director of the Ohio Agricultural Experiment Station, wrote as follows:

"*When manure has been compared with chemical fertilizers the manure usually has been used in such amounts as to carry far larger quantities of the essential elements of fertility than those given in the chemicals* and, without stopping to consider this point, the carbonaceous matter of the manure has been credited with the superior effect produced.

"So firmly has the idea become fixed in the average mind that manure possesses fertilizing properties additional to those due to its chemical constituents, that the suggestion that chemicals may be so employed as to equal the effect of manure, pound for pound of nitrogen and mineral elements contained, has been taken as an attempt to depreciate the value of manure.

"What the experiments described in the foregoing chapter are believed to teach is that manure, as used in ordinary farm practice, owes its value to the nitrogen and inorganic elements contained, and that, by employing manure in the light of the knowledge which modern science has given us, we may very greatly increase its value."

Referring back to the Rothamsted experiment, it is important to note that, although the land was plowed every year in preparation for seeding the wheat, the newly seeded plants soon formed a soil cover. Any bare spaces were filled in with weeds. In the West Virginia experiment, only 4 of the 15 crops that were grown were of the clean-culture type. In the Ohio experiment, only one year in four was devoted to a cultivated crop. These cases are far different from what is going on over a large part of the cotton,

TABLE IV

TWENTY-THREE YEAR COMPARISON OF MANURE AND CHEMICALS—OHIO

Acre Increases in Yield and Value

Treatment	Corn bu.	Oats bu.	Wheat bu.	Clover cwt.	Value Dollars
Manure, 4 tons	11.0	4.1	2.4	2.77	10.00
Equivalent chemicals	10.5	6.0	3.4	1.68	10.78
Manure + P_2O_5*	14.6	7.7	10.1	5.74	21.00
Chemicals + P_2O_5*	13.8	10.0	9.8	6.89	21.48

*Superphosphate, 20 per cent, applied at rate of 380 pounds per acre. They demonstrate quite clearly that chemicals when they supply equivalent amounts of N, P_2O_5 and K_2O, are as effective as manure.

UNDER THE SNOW

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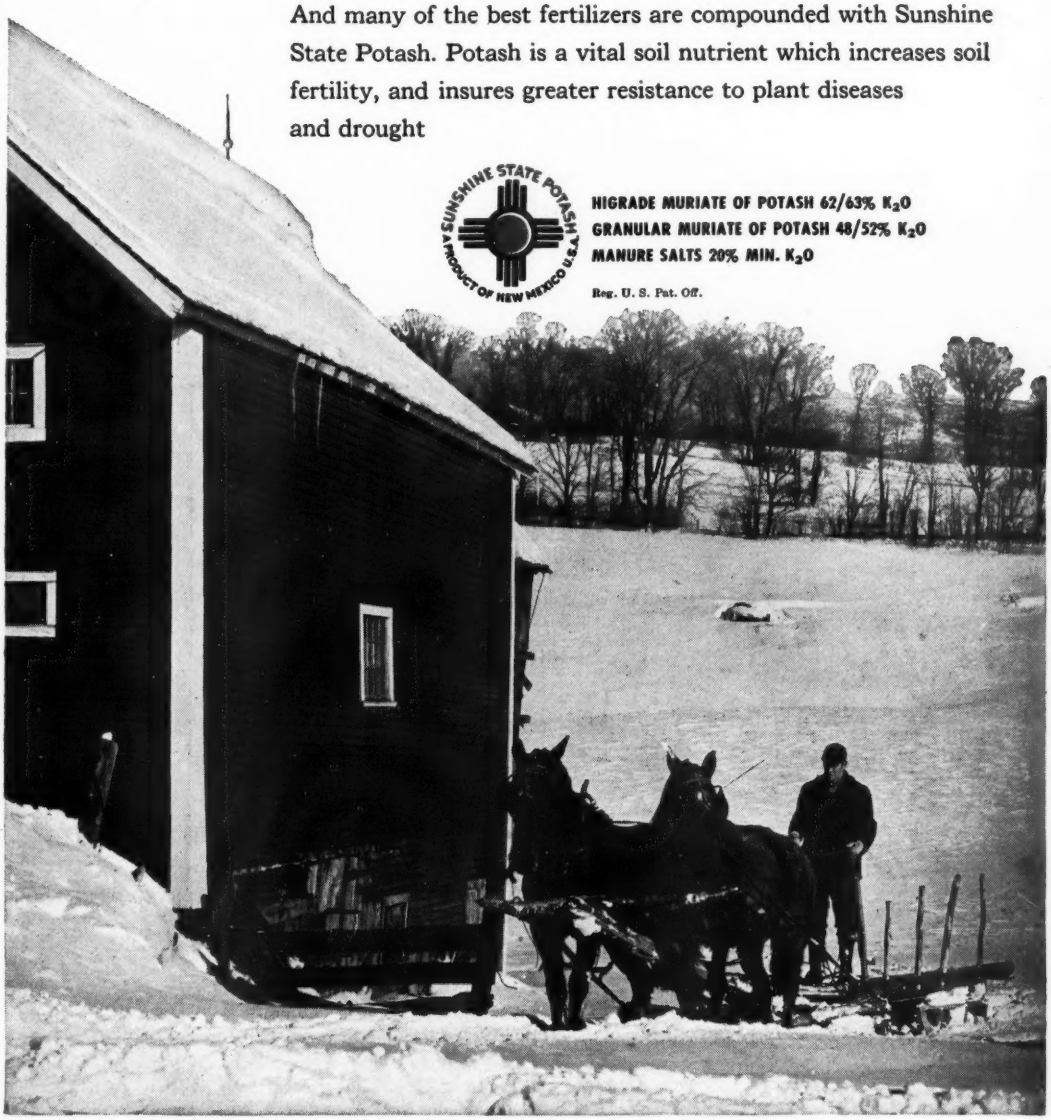

UNITED STATES POTASH COMPANY, *Incorporated,* 30 Rockefeller Plaza, New York 20, N. Y.

corn, soybean, potato, and vegetable-growing areas of this country. In proportion as the land is used more frequently for producing cultivated crops, less opportunity is provided for the legumes and grasses, and these are the organic matter-accumulating crops. When soil is used for the production of such plants as corn, it is exposed to the beating action of heavy rainfall, the rate of loss of topsoil is accelerated, and the rate of decomposition of soil organic matter is speeded up. Growing such crops does not result in an accumulation of soil organic matter, but rather in its reduction.

The point is that fertilizers are being substituted for good farm management over vast areas of land in the United States. Too large a percentage of the land on many farms is being devoted to cultivated crops. This means that the recovery processes, which are associated with the legume and other sod crops, are not being permitted to operate, so that neither the physical nor the chemical properties of soils can be restored.

Conditions with respect to soil deterioration are especially troublesome in the United States. The rainfall around New York, Chicago, St. Louis and New Orleans ranges between 40 and 60 inches annually, and it often comes in torrents. In contrast, the annual rainfall around London, Paris and Berlin is about 25 inches, and it usually comes in gentle showers. Our agriculture is distinctly of clean-culture type, some 150 million acres of row crops being planted every year. Over two million tractors are being used to tear up and run over the soil. A good many thousands of acres of land that once were covered with hay and pasture crops for horse-feed purposes have been torn up by the plow. Many miles of fences that served as barriers to the movement of soil have been removed so the tractor and truck can go farther and faster. The leisurely pace of the horse-and-buggy days has yielded to speed, and this applies to the rate at which water, and the soil that is carried along with it, are going down hill.

More attention will have to be paid to protecting the land against this type of damage. Such soil deterioration is not necessarily the fault of the fertilizer industry, but it has been made possible by that industry and the industry cannot escape its share of the responsibility for it. Without fertilizers, we would long since have been compelled to adopt better systems of soil management. Otherwise we would have gone hungry during World Wars I and II.

Even with adequare amounts of fertilizers at our disposal, we are not too sure about what the situation with respect to the supplies of food and fiber will be, let us say, in the year 2000. Our population is growing at a rate that averages more than a million people per year. This means that the margin of safety between plentiful food supplies and ever-increasing numbers of people is growing smaller.

It is high time that the fertilizer industry began to think seriously about the means by which land can be kept productive without the use of fertilizer. It would be well advised to conduct an educational campaign and finance research projects on the value of sod crops, the possibilities in the growing of legumes, the practices by which soil erosion can be brought under control, and the means by which badly eroded land can be restored to usefulness.

The current outcry of the organic-farming advocates is a mere "tempest in a teapot" in comparison to what may happen if the industry fails to put a stop to the use of fertilizer as substitute for soil conservation. Fertilizers will, if rightly employed, *make poor land good.* But it would be more in keeping with their potentialities if they were used to *make good land better.*

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FOUNDERS AND MACHINISTS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Machine Works, Aurora, Ind.

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

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Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

IMPORTERS, EXPORTERS
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Southern States Phosphate & Fertilizer Co., Savannah, Ga.
Woodward & Dickerson, Inc., Philadelphia, Pa.

INSECTICIDES
American Agricultural Chemical Co., New York City

LEAD BURNERS
Southern Lead Burning Co., Atlanta, Ga.

LIMESTONE
American Agricultural Chemical Co., New York City
Ashcraft-Wilkinson Co., Atlanta, Ga.
McIver & Son, Alex. M., Charleston, S. C.

LOADERS—Car and Wagon
Hough Co., The Frank G., Libertyville, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Acid Making and Handling
Atlanta Utility Works, The, East Point, Ga.
Chemical Construction Corp., New York City
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Ammoniating
Sackett & Sons Co., The A. J., Baltimore, Md.
Sturtevant Mill Company, Boston, Mass.

MACHINERY—Elevating and Conveying
Atlanta Utility Works, The, East Point, Ga.
Baughman Manufacturing Co., Jerseyville, Ill.
Hough Co., The Frank G., Libertyville, Ill.
Hayward Company, The, New York City
Link-Belt Co., Chicago, Ill.
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Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

MACHINERY—Grinding and Pulverizing
Atlanta Utility Works, The, East Point, Ga.
Bradley Pulverizer Co., Allentown, Pa.
Kent Mill Co., Brooklyn, N. Y.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

MACHINERY—Material Handling
Atlanta Utility Works, The, East Point, Ga.
Baughman Manufacturing Co., Jerseyville, Ill.
Hayward Company, The, New York City
Hough Co., The Frank G., Libertyville, Ill.
Link-Belt Co., Chicago, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

MACHINERY—Mixing, Screening and Bagging
Atlanta Utility Works, The, East Point, Ga.
Link-Belt Co., Chicago, Ill.
Sackett & Sons Co., The A. J., Baltimore Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

MACHINERY—Power Transmission
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Superphosphate Manufacturing
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

MANGANESE SULPHATE
McIver & Son, Alex. M., Charleston, S. C.

MINOR ELEMENTS
Tennessee Corporation, Atlanta, Ga.

MIXERS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

NITRATE OF SODA
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.

NITROGEN SOLUTIONS
Lion Oil Company, El Dorado, Ark.
Spencer Chemical Co., Kansas City, Mo.

NITROGENOUS ORGANIC MATERIAL
American Agriculture Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Davidson Commission Co., The, Chicago, Ill.
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

NOZZLES—Spray
Monarch Mfg. Works, Philadelphia, Pa.

PHOSPHATE ROCK
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Virginia-Carolina Chemical Corp., Richmond, Va.

PLANT CONSTRUCTION—Fertilizer and Acid
Atlanta Utility Works, The, East Point, Ga.
Chemical Construction Corp., New York City
Monsanto Chemical Co., St. Louis, Mo.
Sackett & Sons Co., The A. J., Baltimore, Md.
Southern Lead Burning Co., Atlanta, Ga.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Titlestad Corporation, Nicolay, New York City

POTASH SALTS—Dealers and Brokers
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
Jackle, Frank R., New York City

POTASH SALTS—Manufacturers
American Potash and Chem. Corp., New York City
Potash Co. of America, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
United States Potash Co., New York City

PRINTING PRESSES—Bag
Schmutz Mfg. Co., Louisville, Ky.

PYRITES—Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.

REPAIR PARTS AND CASTINGS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

BUYERS' GUIDE

Stedman's Foundry and Mach. Works, Aurora, Ind.

SCALES—Including Automatic Bagging
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SCREENS
Atlanta Utility Works, The, East Point, Ga.
Link-Belt Co., Chicago, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

SEPARATORS—Air
Kent Mill Co., Brooklyn, N. Y.
Sackett & Sons Co., The A. J., Baltimore, Md.
Sturtevant Mill Co., Boston, Mass.

SPRAYS—Acid Chambers
Monarch Mfg. Works, Inc., Philadelphia, Pa.

SULPHATE OF AMMONIA
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

SULPHUR
Ashcraft-Wilkinson Co., Atlanta, Ga.

SULPHURIC ACID
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Southern States Phosphate Fertilizer Co., Savannah, Ga.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

SUPERPHOSPHATE
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, G.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Davison Chemical Corporation, Baltimore, Md.
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
Jackle, Frank R., New York City
Southern States Phosphate Fertilizer Co., Savannah, Ga.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

SUPERPHOSPHATE—Concentrated
Armour Fertilizer Works, Atlanta, Ga.
International Minerals & Chemical Corporation, Chicago, Ill.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

TAGS
Keener Mfg. Co., Lancaster, Pa.

TANKAGE
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Davidson Commission Co., The, Chicago, Ill.
International Minerals & Chemical Corporation, Chicago, Ill.
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

VALVES
Atlanta Utility Works, The, East Point, Ga.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

Alphabetical List of Advertisers

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2. Service . . . we make every effort to give you the service you want and deserve.

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POTASH COMPANY OF AMERICA

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GENERAL SALES OFFICE . . 50 Broadway, New York, N. Y. • MIDWESTERN SALES OFFICE . . First National Bank Bldg., Peoria, Ill.
SOUTHERN SALES OFFICE . . Candler Building, Atlanta, Ga.